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ABSTRACT

The learning approaches of secondary students were studied for 495 eighth-, tenth- and twelfth-grade students in Singapore. The focus was on determining: (1) the dominant approach used by students in learning different academic subjects (English, Chinese, mathematics, and science); (2) the motive-strategy consequence in learning these different subjects in grades 8, 10, and 12; and (3) the different learning approaches used by better (express) and weaker (normal) students. Normal students were motivated to learn the subject for its usefulness to them; express students were more likely to have intrinsic interest in the subject. Normal students were more likely to use rote learning and to rely heavily on teachers' notes and past examinations, while express students were more likely to look for relationships between new and old concepts learned, showing a more reflective approach in their learning. The express students used effective retention strategies more frequently and exhibited better examination techniques than did normal students. Overall, when strategies were viewed in terms identified by J. Biggs (1979), these secondary students, irrespective of grade and subject, showed a preference for deep and achieving strategies. That weaker students were more likely to favor the Surface Approach was an expected finding, but one educators should consider in their efforts to help weak learners. Six data tables are included. (SLD)

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Do Students' Motives in Learning A Subject Affect Their Choice of Learning Strategies?

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Research into learning approaches becomes more intense and critical when approaches to learning are used to account for the qualititative and quantitative outcomes in learning. It was Marton (1975) who introduced the concept of "Approaches to learning" to research in this area. He also introduced the "Deep" and "Surface" approaches. The difference in the two approaches is perceived in the intentions and the process that follows to achieve the objective. It is evident that the approach adopted by the student is variable over time and over situations. In this variability, the effects of motivation on approach stand out clearly.

In the quantitative study of approaches to learning inventories were developed to confirm and extend the definitions of Marton's concepts and categories. In the factor analysis of the inventory devised by Entwistle, Hanley & Hounsell (1979) three main factors, each with a distinct motivational component, were identified. Factor I linked Deep Approach and Comprehension Learning with Intrinsic Motivation. Factor II indicated connections between Surface Approach, Operation Learning, and both Fear of Failure and Extrinsic Motivation. Factor III brought together Organized Study Methods, Positive Attitudes and Achievement Motivation.

Biggs (1979) has independently developed a strikingly similar structure linking study strategies and motivation. Over-time, Biggs refined his model of student learning. In this model, he introduces the "learning process complex" which refers primarily to student's motives and strategies for learning. Each motive-strategy combination signifies a distinct approach to learning. Three common approaches have also been identified by factor analysis by Biggs - Surface, Deep and Achieving. (refer to Entwistle, Hantley and Hounsell, 1979; Entwistle and Ramsden, 1983; Watkins, 1983; Biggs, 1987, 1989)

The Surface Approach is founded on extrinsic motivation, so that learning is perceived as a means towards an end such as passing an examination or getting a job. The effort is directed towards achieving the goal with minimal time and stress and the strategy chosen is usually limited to the basic essentials such as memorization through rote learning.

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The Deep Approach is built on the foundation of interest in the subject matter of the task. The strategy ensuing from this interest is to maximize understanding of concepts and the relationships between them.

Achievement motivation is the key to the Achieving Approach. The intention is to succeed and be competitive, and normally through high marks and grades. The related strategies centre on managing time, learning environment and syllabus coverage in the most efficient way.

Ramsden (1984) has found that the different approaches demand a different balance of learning processes in contrasting academic disciplines. It was observed that Science students rely on operation learning much more than arts students who scored better on comprehension learning (Entwistle and Ramsden 1983). For some subjects, the rote learning of definitions, formulae or information is an essential component and may also feature prominently in the initial introduction of a new topic. Thus the meaning of each approach needs to be reinterpreted within each subject area and within each discipline.

A number of studies showed that scientific and professional fields are more inclined to the formal didactic teaching methods and are less liberal in their dealings with their students . Humanities and Social Science teachers are less likely to motivate students through evaluation (Wilson, Gaff, Dienst, Wood and Bevry, 1975). Hence it is not unexpected that students perceived applied and scientific fields as being more demanding in terms of time and commitment and less self-directing.

In Biggs' study (1987), he found that year effects on all surface-related scales showed a decline from age 14 to year 11 as do achieving related scales. The deep-related scales showed a strong Sex-Year interaction: boys decreased across age 14 to Year 11, but girls increased. In the same study, Biggs also examined the interaction between all favourite subjects, sex and year. All subjects (Art-Music, Humanities, Maths-Science, Technical) showed a decrease in scores for both Deep-Achieving and Surface Approaches' from Age 14 to Year 11. But there were distinct differences between subject areas. At both age 14 and Year 11, the Science and Humanities subjects were preferred by students with the highest scores on Deep Achieving Approach. Technical subjects were preferred by students highest on Surface Approach and Art-Music by the lowest on Surface Approach.

Students' conceptions of learning reflect their previous experiences of learning in scholastic settings. There is research evidence showing that learning tasks set in the lower primary levels have strongly influenced the development of a quantitative and unreflective conception of learning (Bennett, Desforges, Cockburn and Wilkinson, 1984).

Kirby and Biggs (1981) examined the relative effectiveness of congruent and non-congruent strategies in teacher rated English and Mathematics performance. They found that well-motivated and achieving students selected strategies congruent with their motivational pattern and used them effectively, while poor achievers used achieving strategies which were non-congruent with their prevailing motivational patterns. Other similar studies (Svensson, 1976, 1977; Watkins, 1983; Van Rossum and Schenk, 1984; Chang, 1989) yielded similar results indicating that better students selected deep and reflective strategies while weaker students favoured the surface approach.

The present study attempts to find out

a. the dominant approach used by secondary students in learning different academic subjects (English, Chinese, Mathematics and Science);

b. the motive-strategy congruence in the learning of different academic subjects (English, Chinese, Mathematics and Science) in Grades 8, 10 and 12;

c. the different learning approaches employed by the better (Express) and weak (Normal) students.

METHODOLOGY

SAMPLE

The sample was drawn from only two government co-educational schools as the data used were collected at the piloting stage of the project. Altogether, 495 pupils participated in this pilot study. Three levels of pupils, Grades 8, 10 and 12, were selected. Grades 8, 10 and 12 are crucial years in the Secondary school as they signify important examinations for the pupils. At Grade 8, pupils are streamed into Science, Arts, Commerce or Technical classes according to their final examination results. GCE 'O' Level and GCE 'A' Level Examinations take place at the end of Grades 10 and 12 respectively.

In Singapore, pupils are streamed into SAP (Special Assisted Programme), Express or Normal Classes based on the strength of their PSLE results. The top ten percent of the PSLE (Primary Six Leaving Examination) are given the option of joining nine specially chosen schools which offer English and Chinese at the first language level. Express pupils will take their 'O' level examinations in 4 years while the weaker Normal pupils will only take their 'O' level examinations at the end of the 5th year. The two sample schools have only Express and Normal classes. Express pupils were sampled from one school and the other school supplied the Normal pupils. The number of boys and girls was

roughly balanced.

Instrumentation

The instruments comprise Biggs' Learning Process Questionnaire (LPQ) and writer's items, specific to subject groups. Three sets of the Questionnaire were developed, namely Languages, Social Studies and, Mathematics and Sciences. Each Questionnaire has three sections A, B and C. Section A lists the 36 items from the Learning Process Questionnaire and Section B contains generic items, identical in all Questionnaires. Section C represents strategies which are specific to the respective subjects in the Questionnaires.

From Section A, there are 6 items for each subscales on Surface Motive, Surface Strategy, Deep motive, Deep Strategy, Achieving Motive and Achieving Strategy. The Surface, Deep and Achieving Approaches are obtained by adding the respective Motive and Strategy.

In Singapore, Languages, Mathematics and Science are considered the core subjects of the curriculum. For this paper only the results of these key subjects will be examined and discussed. Moreover, the Languages and the Sciences would offer a good contrast in terms of strategies used.

RESULTS

The results are analysed subject by subject in the following order:

English
Chinese
Mathematics
Science

The differences in the motives expressed and the strategies employed by the Grade 10 Normal (weaker) and Express (better) pipils were also examined.

English

There was a consistent decrease in the subscale scores (Surface Motive, Surface Strategy Deep Motive, Deep Strategy, Achieving Motive, Achieving Strategy) as the academic level of the respondents increased (Table 1a). With the exception of Surface Strategy and Deep Motive, the differences in means between levels for the other subscales were statistically significant. The Surface Approach and Achieving Approach showed significant differences in their means between levels at the .001 level while the differences in the Deep Approach achieved

the .016 level of significance.

When the subscale statistical scores were compared within each level, some interesting trends could be observed. For the younger pupils at Grades 8 and 10, the Surface Motive scores were the highest while the Deep Motive scores were the lowest of the three motives. In contrast, the Surface Strategy scores ranked the lowest among the strategy scores for these two levels. The Achieving Strategy had gained the highest scores and the Achieving Approach seemed to be favoured by the younger pupils. Though the pupils were high on the Surface Motive, the Surface Approach (39.56, 37.12) was edged out marginally, by the Deep Approach (39.64, 37.86) and comfortably by the Achieving Approach (41.69, 39.26).

For the Grade 12 pupils, the picture was quite different. The Deep Motive, Deep Strategy and Deep Approach scores topped the list in all the sub-scale categories. The Achieving Motive, Achieving Strategy and Achieving Approach were relegated to the third place of the respective categories.

The correlations between motives and strategies in Table 1b show the match between Surface Motives and Surface Strategy, between Deep Motive and Deep Strategy and between Achieving Motive and Achieving Strategy. For the Grade 8 level, the Achieving Motive correlated significantly with all the strategies while the Deep Motive showed strong relationships with both the Deep and Achieving Strategies. For Grade 10, the pattern, of correlations was rather similar to that of Grade 8 except that the correlation between Achieving Motive and Surface Strategy was not significant. For Grade 12, the Achieving Motive had a significant relationship only with the Achieving Strategy. It is noteworthy that for all levels, the Deep Motive was strongly linked to both Deep and Achieving strategies.

Chinese

For Chinese, a language which is ideographic rather than phonic like English, one may expect a different pattern in the choice of strategies to achieve the same motive. Generally, one can perceive a similar pattern of decrease in scores for most of the subscales as the grade ascended. Exceptions were seen in the Surface Strategy and Deep Motive at Grade 12. (Table 2a)

For the Approaches, the decrease in scores of the three Approaches was consistent across the grade levels but the differences between means were significant only for the Surface Approach. For Grade 8, the Surface Approach was rated top (38.89) while the Achieving Approach was a close second (38.67). The Achieving Approach edged out the other two Approaches for Grade 10. The more mature Grade 12 showed a greater preference

for the Deep (34.33) and Achieving Approaches (34.26).

For Grade 8, there was no significant relationship between Surface Motive and the corresponding strategy. (Table 2b) Deep and Achieving Motives however correlated significantly ($p<.001$) with both Deep and Achieving Strategies. The pattern of correlations was similar for Grades 10 and 12. The match between Surface Motive and Surface Strategy was congruous and significant at the 0.05 level. Deep Motive correlated strongly with both Deep and Achieving Strategies. But for the Achieving Motive, significant relationship was only evident with Achieving Strategy.

Mathematics

The scores for Mathematics fell into a slightly different pattern compared to English and Chinese (Table 3a) It is quite noticeable that the scores for Grade 10 were higher for the subscales: Surface Strategy, Deep Motive and Achieving Motive. The differences in Subscale Scores across levels were significant for Surface Motive, Deep motive, and Achieving Strategy.

The Surface Approach showed decreasing scores for ascending levels and the differences between levels were significant at the .024 level. While Grade 10 had top scores for Deep and Achieving Approaches, Grade 12 had to settle for the lowest scores for all the three Approaches. Differences between levels were also significant for the Achieving Approaches. For all the three levels, the Achieving Approach ranked top, followed by the Deep Approach.

At all levels, both Deep and Achieving Motives correlated significantly with Deep and Achieving strategies, indicating a strong Deep-Achieving link (Table 3b). Surface Motive did not show any strong match with any of the strategies for Grades 8 and 12. But for Grade 10, Surface Motive showed significant relationships with Surface and Achieving Strategies.

Science

Like Mathematics, the trend of the scores for some subscales in Science was rather unexpected (Table 4a). Surface Motive, Achieving Motive and Achieving Strategy followed the previous trend of decreasing scores for increasing grades. Unusual trends were noted in Surface Strategy, Deep Motive and Deep Strategy. But differences between scores across levels were significant only for Surface Strategy.

For the three Approaches, no significant differences were detected across levels. For Grades 8 and 10, the Achieving Approach was favoured by the pupils. The Deep Approach came a

close second. This pattern is the exact replica of Mathematics. A difference emerged for Grade 12, with the Deep Approach eclipsing the Achieving Approach.

Deep Motive correlated significantly with both Deep and Achieving Strategies for all the Grades (Table 4b) Achieving Motive showed strong relationships with Deep and Achieving Strategies for Grades 8 and 10 but not for Grade 12. There was also congruence between Surface Motive and Surface Strategy for the lower grades. It was rather unexpected to get a negative though non-significant relationship between Surface Motive and Surface Strategy at Grade 12.

The academic subjects generally showed significant relationships between the motives and the corresponding strategies. Being aware of one's motives and selecting appropriate matching strategies to achieve one's goals signify that metalearning processes are evident in the pupils.

The next section gives a close examination of the motives professed by the Grade 10 Express and Normal pupils and the strategies used by them in learning English and Mathematics.

Motives and Strategies employed by Express and Normal pupils at Grade 10.

Results indicate that:

Motives (Table 5)

a) Normal pupils were motivated in learning a subject for its usefulness in enhancing career prospect rather than an interest in the subject itself. Express pupils showed greater enjoyment in learning the subject.

Strategies (Table 6)

b) Normal pupils tended to use more rote learning while Express pupils would look for relationships between new and old concepts learned, showing a more reflective approach in their learning.

c) Express pupils employed effective retention strategies more frequently than Normal pupils.

d) In their preparation for tests/examinations, Normal pupils concentrated heavily on notes given by the teachers and on solving questions/problems set in past-year examinations.

e) Express pupils exhibited better examination techniques too.

The above data showed an apparent link between the strategies employed by the pupils and their academic performance.

DISCUSSION

As in Biggs' Study (1987), the year effects were reflected in the study by a general decline in scores for the subscales as well as for approaches from Grade 8 to Grade 12. Probably older children were more cynical and cautious in their ratings.

With the exception for Chinese at Grade 8, the Surface Approach was not a hot favourite with the Singapore pupils in the four subjects under study. The Achieving Approach ranked top for most of the 4 subjects across levels. Even for English, Chinese and Science where the more mature Grade 12 pupils showed a higher score for the Deep Approach, the scores for the Achieving Approach were never too far behind. The correlational studies also indicated a strong Deep-Achieving link.

This strong support shown by the Singapore pupils for the Achieving Approach can be explained by the societal stress on competition and excellence in Singapore. The academic press in all schools, irrespective of student types is very strong (Quek and Chang, 1989). But it is gratifying to learn that the Deep Approach ranked a close second to the Achieving Approach, indicating an intrinsic interest in learning the subjects.

The Deep Approach favoured by the Grade 12 pupils in three contrasting subjects, English, Chinese and Science, speaks well for the maturity and depth of the older pupils in their orientation towards learning. The data do not support the earlier findings by Wilson et al (1975) and Entwistle and Ramsden (1983). Their findings tend to associate Science subjects with Surface Learning and Humanities with Deep Learning. But Biggs' Australian data (1987) receive confirmation from the Singapore findings. Probably, the demands made of pupils in class assessments and the goals emphasized in class would influence pupils in their approaches towards learning. According to Ames and Archer (1988), pupils who perceived an emphasis on mastery goals in the classroom, tended to use more effective strategies and expressed more positive attitudes towards schooling and learning.

The Surface Approach adopted by the young pupils at Grade 8 in learning Chinese is quite understandable. Chinese, traditionally requires young learners to do a lot of memorization of characters and idioms. Another influence could have come from their primary experience which does not require much reflective thinking (Bennett, Desforges, Cockburn and Wilkinson, 1984).

The correlational studies show strong motive-strategy congruence in the Deep and Achieving Approaches for all subjects across levels. The close link between the two approaches are further supported here. Though congruence is also perceived between Surface Motive and Surface Strategy, the relationship between them is more tenuous, significant in most cases at the .05 level. It is noteworthy that Surface Motives for all 4 subjects across levels achieved high scores but the Surface Strategy scores usually ranked very low when compared to Deep and Achieving Strategies. Pupils in a success-oriented society would want to pass well in their tests, with the aim of securing a good job in the near future. But the higher order questions in examinations demand comprehension and understanding, especially in subjects like Languages and Sciences. Thus Surface Strategy will not be adequate to meet the demands of class goals.

The extrinsic motives expressed by the weaker pupils (Normal) were matched by their choice of rote learning methods and the dependence on teachers' notes and past examination questions. In contrast, the Express pupils showed intrinsic interest in their subjects and selected strategies wisely to achieve their objectives of understanding the subject matter. Other studies done in Australia, America, Singapore and the United Kingdom have arrived at similar conclusions (Svensson, 1976; 1977; Kirby and Biggs, 1981; Watkins, 1983; Van Rossum and Schenk, 1984; Chew, 1988; Khoo, 1989, Chang, 1989).

CONCLUSION

The results are encouraging as they indicate that Singapore pupils irrespective of levels and subjects showed a preference for Deep and Achieving Strategies. The match between the motives and strategies also signifies that metalearning has taken place. Class goals, assessment demands and societal norms exert strong influences on the learning orientation of pupils. But it is a sobering though expected revelation that the weaker pupils favoured the Surface Approach. Yet there is hope that these findings will guide teachers in their intervention programmes to help these weak learners.

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Table 1a : Means and Standard Deviations of LPQ Subscale Scores in English for Grades 8, 10 and 12 pupils

SUBSCALE	GRADE LEVEL	8 (n=41)	10 (n=43)	12 (n=33	F	P
Surface Motive	Mean	22.73	21.21	17.73	11.91	0.000
	S.D.	5.02	3.67	4.63		
Surface Strategy	Mean	16.83	15.91	15.18	1.31	0.273
	S.D.	4.32	4.39	4.48		
Surface Approach	Mean	39.56	37.12	32.91	7.62	0.001
	S.D.	7.98	6.74	7.18		
Deep Motive	Mean	20.54	19.79	18.18	2.59	0.080
	S.D.	3.99	4.61	4.88		
Deep Strategy	Mean	19.10	18.07	15.73	4.62	0.012
	S.D.	4.93	4.31	5.25		
Deep Approach	Mean	39.64	37.86	33.91	4.32	0.016
	S.D.	8.35	7.53	9.60		
Achieving Motive	Mean	22.15	20.79	16.69	13.12	0.0001
	S.D.	4.47	3.74	5.88		
Achieving Strategy	Mean	19.54	18.47	14.76	9.69	0.0001
	S.D.	4.69	4.57	5.24		
Achieving Approach	Mean	41.69	39.26	31.45	15.12	0.0001
	S.D.	8.04	6.71	10.00		

Table 1b : Correlations between Motives and Strategies for English in Grades 8, 10 and 12.

Grade 8 (i)

	SM	DM	AM
SS	.459**	.001	.386**
DS	.199	.748***	.524***
AS	.123	.524***	.541***

Grade 10 (ii)

	SM	DM	AM
SS	.421***	-.034	.116
DS	.141	.610***	.458***
AS	.116	.395***	.411***

Grade 12 (iii)

	SM	DM	AM
SS	.427*	.124	.089
DS	-.199	.601**	.354
AS	.186	.666***	.626***

*** $p < .001$
** $p < .01$
* $p < .05$

Table 2a : Means and Standard Deviations of LPQ Subscale Scores in Chinese for Grades 8, 10 and 12 pupils

SUBSCALE	GRADE LEVEL	8 (n=41)	10 (n=43)	12 (n=33)	F	P
Surface Motive	Mean	21.78	19.36	16.67	10.59	0.0001
	S.D.	3.08	4.33	5.20		
Surface Strategy	Mean	17.11	15.11	15.26	2.27	0.109
	S.D.	3.85	4.22	5.12		
Surface Approach	Mean	38.89	34.47	31.93	7.59	0.001
	S.D.	6.34	7.02	8.54		
Deep Motive	Mean	18.39	18.03	18.85	2.29	0.751
	S.D.	4.68	3.73	4.37		
Deep Strategy	Mean	17.69	17.28	15.48	1.47	0.035
	S.D.	5.30	5.12	5.47		
Deep Approach	Mean	36.08	35.31	34.32	0.31	0.736
	S.D.	9.45	7.89	8.90		
Achieving Motive	Mean	20.36	20.17	18.63	1.37	0.259
	S.D.	4.80	3.49	4.91		
Achieving Strategy	Mean	18.31	17.83	15.63	2.26	0.110
	S.D.	4.90	5.28	5.39		
Achieving Approach	Mean	38.67	38.00	34.26	2.35	0.100
	S.D.	8.43	7.71	9.28		

Table 2b : Correlations between Motives and Strategies for Chinese in Grades 8, 10 and 12.

Grade 8 (i)

	SM	DM	AM
SS	.169	-.028	-.030
DS	.075	.476***	.678***
AS	.074	.503***	.623***

Grade 10 (ii)

	SM	DM	AM
SS	.348*	-.076	.163
DS	.032	.578***	.270
AS	.045	.460**	.525***

Grade 12 (iii)

	SM	DM	AM
SS	.427*	.124	.089
DS	-.119	.601**	.354
AS	.186	.666***	.626***

*** $p < .001$
** $p < .01$
* $p < .05$

Table 3a : Means and Standard Deviations of LPQ Subscale Scores in Mathematics for Grades 8, 10 and 12 pupils

SUBSCALE	GRADE LEVEL	8 (n=48)	10 (n=125)	12 (n=35)	F	P
Surface Motive	Mean	20.40	19.71	17.23	5.97	0.003
	S.D.	3.95	4.53	4.10		
Surface Strategy	Mean	15.67	16.06	15.14	0.79	0.456
	S.D.	3.74	4.09	3.72		
Surface Approach	Mean	36.07	35.77	32.37	7.59	0.001
	S.D.	5.88	7.27	6.52		
Deep Motive	Mean	18.35	20.43	18.88	5.76	0.004
	S.D.	3.77	3.94	4.06		
Deep Strategy	Mean	18.00	17.22	16.02	1.57	0.211
	S.D.	5.15	4.92	5.14		
Deep Approach	Mean	36.35	37.65	34.90	1.75	0.177
	S.D.	7.69	7.96	8.54		
Achieving Motive	Mean	20.17	21.04	18.91	2.59	0.077
	S.D.	4.97	4.62	6.25		
Achieving Strategy	Mean	18.75	18.09	16.06	3.48	0.033
	S.D.	4.98	4.61	4.99		
Achieving Approach	Mean	38.92	39.13	34.97	3.54	0.031
	S.D.	8.96	7.75	9.38		

Table 3b : Correlations between Motives and Strategies for Mathematics in Grades 8, 10 and 12.

Grade 8 (i)

	SM	DM	AM
SS	.169	-.028	-.030
DS	.075	.476***	.678***
AS	.074	.503***	.623***

Grade 10 (ii)

	SM	DM	AM
SS	.421***	-.034	.116
DS	.141	.610***	.395***
AS	.243**	.458***	.411***

Grade 12 (iii)

	SM	DM	AM
SS	.344	.020	-.070
DS	.193	.724***	.520**
AS	.252	.564***	.463**

*** $p < .001$
** $p < .01$
* $p < .05$

Table 4a : Means and Standard Deviations of LPQ Subscale Scores in Science for Grades 8, 10 and 12 pupils

SUBSCALE	GRADE LEVEL	8 (n=48)	10 (n=125)	12 (n=35)	F	P
Surface Motive	Mean	19.88	18.73	17.94	1.82	0.166
	S.D.	3.56	4.40	3.98		
Surface Strategy	Mean	16.02	16.72	13.94	3.16	0.046
	S.D.	3.66	4.50	3.11		
Surface Approach	Mean	35.90	35.45	31.88	2.47	0.089
	S.D.	5.79	7.42	5.37		
Deep Motive	Mean	19.35	20.12	20.41	0.67	0.514
	S.D.	3.67	4.38	3.41		
Deep Strategy	Mean	19.00	17.65	20.12	1.86	0.160
	S.D.	4.50	5.54	5.18		
Deep Approach	Mean	38.35	37.77	40.53	0.71	0.494
	S.D.	7.14	9.26	8.82		
Achieving Motive	Mean	20.58	20.48	18.29	0.53	0.593
	S.D.	4.57	4.53	5.19		
Achieving Strategy	Mean	20.13	18.27	18.00	2.24	0.111
	S.D.	4.75	5.11	4.91		
Achieving Approach	Mean	40.71	38.75	37.29	1.33	0.268
	S.D.	8.13	8.38	8.24		

Table 4b : Correlations between Motives and Strategies for Science in Grades 8, 10 and 12.

Grade 8 (i)

	SM	DM	AM
SS	.286*	-.021	-.017
DS	.120	.526***	.633***
AS	.007	.394**	.521***

Grade 10 (ii)

	SM	DM	AM
SS	.389**	-.066	.213
DS	.101	.740***	.460***
AS	.280*	.573***	.507***

Grade 12 (iii)

	SM	DM	AM
SS	-.146	-.388	-.355
DS	.239	.879***	.490
AS	.134	.581***	.466

*** $p < .001$
** $p < .01$
* $p < .05$

Table 5 : Means of Items on Motivation in Learning

	ITEM	STREAM	ENGLISH	MATHS
1.	I choose to do the subject mainly because of career prospects when I leave school, not because I'm particularly interested in it.	N*	3.85	3.55
		E**	2.94+	2.55+++
2.	Whether I like it or not, I can see that studying the subject is for me a good way to get a well-paid or secure job.	N	4.23	3.94
		E	3.71	3.38+
3.	I will continue to take the subject for as long as necessary to get a good job.	N	4.31	3.81
		E	4.00	3.61
4.	I take a greater interest in a lesson if I know the aims of the lesson and how useful it is to me.	N	3.81	3.94
		E	3.82	3.29++
5.	I enjoy learning this subject	N	3.23	3.48
		E	3.82	3.94

* N = Normal
** E = Express

t-tests

+++ $p < .001$
++ $p < .01$
+ $P < .05$

Table 6 : Means of Items on Learning Strategies

	ITEM	STREAM	ENGLISH	MATHS
1.	I find that the only way to learn the subject is to memorize it by heart.	N E	2.38 2.24	3.00 2.00+++
2.	I prefer the subject in which I have to learn just facts to on which requires a lot of reading and understanding of material.	N E	3.37 2.71	3.39 2.80+
3.	I find it better to learn just the subject facts and details about a topic rather than try to understand all about it.	N E	2.58 2.35	2.74 2.18+
4.	In reading new materials, I am often reminded of materials I already know and see the old materials in a new light.	N E	2.69 3.29	2.48 3.16++
5.	I try to relate what I have learned in this subject to what I already know in other subjects.	N E	2.65 3.29	3.13 2.97
6.	When a test is returned, I go over it carefully correcting all errors and trying to understand why I make the original mistakes.	N E	3.46 3.59	3.84 4.00
7.	I turn an explanation/ argument over in my mind a number of times before accepting it.	N E	2.73 3.88++	3.35 3.35
8.	I try to rephrase notes and questions in my own words.	N E	2.81 3.24	2.45 2.31
9.	I stop to check what I remember after reading each section in a chapter.	N E	2.85 3.00	2.97 3.05

t-tests
+++ $p < .001$
++ $p < .01$
+ $p < .05$

	ITEM	STREAM	ENGLISH	MATHS
10.	To remember between, I check main headings and summary before I read a chapter/ article.	N E	2.88 3.53	3.19 3.21
11.	I underline/colour the key headings and important words in my notes.	N E	3.58 3.71	3.88 4.18
12.	It helps me to remember if I use abbreviations/acronyms for terms/places/names.	N E	2.50 3.18	2.61 2.81
13.	I only use the notes given in class by the teacher.	N E	3.35 2.65	3.55 2.95
14.	In my revision, it is important to me to be able to solve questions/problems set in past-year examination.	N E	4.08 3.35+	4.19 3.89
15.	I underline the key words in examination questions.	N E	2.77 3.82+	2.90 2.70
16.	I spend time to recall the key points and write a brief outline to examination questions/assignments/problems.	N E	2.81 3.05	2.65 2.55
17.	I make it a point to check my answer to a question/problem before handing in my paper.	N E	4.19 4.24	3.81 4.13
18.	Before starting a test, I plan how much time to spend on each section of the test.	N E	2.23 2.65	2.52 2.48

t-tests
+++ p < .001
++ p < .01
+ p < .05

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References

1. Ames, C. and Archer, J. (1988) Achievement Goals in the Classroom: Students' Learning Strategies and Motivation Processes, Journal of Educational Psychology, 10, 3, 260-267.

2. Bennett, N; Desforges, C.; Cockburn, A, and Wilkinson, B (1984) The quality of pupil learning experiences. Hillsdale, NJ : Erlbaum.

3. Biggs, J. (1979). Individual differences in study processes and the quality of learning outcomes, Higher Education, 8, 381-394.

4. Biggs, J. (1987). Student Approaches to Learning and Studying. Victoria : ACER.

5. Biggs, J. (1989) Approaches to Learning in Two Cultures. In Teaching and Learning Styles within and across Cultures. (ed. V. Bickley). Hong Kong: Institute of Language in Education.

6. Chang, S. C. (1989). A Study of Learning Strategies Employed by Secondary Four Express and Normal Pupils. Paper presented at the Sixth ASEAN Forum on Child and Adolescent Psychiatry, Singapore, 30 March - 2 April.

7. Chew, E. (1988) The Impact of Study Skills on Academic Achievement. Unpublished academic assignment, Institute of Education, Singapore.

8. Entwistle, N.; Hanley, M. and Hounsell, D. (1979). Identifying distinctive approaches to studying, Higher Education, 8, 365 - 380.

9. Entwistle, N. and Ramsden, P. (1983) Understanding Student Learning. London : Croom Helm.

10. Khoo, G. H. (1989). Effects of Study Skills and Habits on Academic Performance. Unpublished academic assignment, Institute of Education, Singapore.

11. Kirby, J. and Biggs, J. (1981) Learning Styles, information processing abilities, and academic achievement. Final Report, Australian Report, Australian Research Grants Committee, Belconnen ACT.

12. Marton, F. (1975). What does it take to learn? In Strategies for research and development in higher education. (ed. N.J. Entwistle). Amsterdam : Sweets and Zeltlinger. 32 - 43.

13. Quek, M. and Chang, S. C. (1989) The Influence of Pears on the Academic Self-Concept of Secondary Three Normal Course Students. Paper presented at the 3rd ERA conference, Singapore, 23-24 June.

14. Ramsden, P. (1984) The Context of Learning. In The Experience of Learning. (eds. F. Marton, D. Hounsell and N. Entwistle). Edinburgh; Scottish Academic Press. 144-164.

15. Svensson, L. (1976) Study Skill and Leaning. Gothenburg : Acta Universitatis Gothoburgensis.

16. Svensson, L. (1977) On qualitative differences in learning : III. Study Skill and learning, British Journal of Educational Psychology, 47, 233-243.

17. Van Rossum, E. and Schenk, S. (1984) The relationship between learning conception, study strategy and learning outcome, British Journal of Educational Psychology, 54, 73-83.

18. Watkins, D. (1983) Depth of processing and the quality of learning outcomes, Instructional Science, 12, 49 -53.

19. Wilson, R.; Gaff, J,; Dienst, E,; Wood, L. and Bavry, J. (1975) College professors and their impact on students. New York: Wiley.

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